ARTHROPOD CONSORTES OF A KIT FOX DEN[1]

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Studies of the kit fox, *Vulpes macrotis nevadensis* Goldman, in Utah prior to 1956 had been concerned primarily with taxonomy and distribution. The recent study by Egoscue (1956) of the life history and habits of the kit fox was a timely and much needed contribution to our knowledge of this animal. One objective of his study was to determine the potential role of this fox in the epizoology of endemic diseases. To understand the various epidemiological implications and to develop host-parasite relationships, the arthropod contents of a den were examined. The objective of the present study is to report on the arthropods recovered by Egoscue (1956) from a kit fox den. To the extent of the author's knowledge such information has not previously been reported. It is unfortunate that fox populations were not large enough to permit excavation of several dens without upsetting other phases of study.

Methods and Materials

Beginning with the dirt ramp (Fig. 1) and at given intervals (Table I) within the tunnel, blocks of soil were collected and screened through a series of soil sieves, the smallest having a 200 mesh screen. Each block was the width of the tunnel floor, two inches in depth, and six to eight inches long. To eliminate screening large volumes of soil it was necessary to take each sample before the tunnel floor was disturbed or covered with soil loosened by excavation. Therefore, each sample was obtained by reaching into the tunnel 15 to 18 inches beyond the point to which excavation had progressed. All arthropods recovered were transferred to 70 per cent alcohol with forceps and a camel's-hair brush.

Mites, lice, and fleas were mounted on microslides for identification. The mites were mounted in poly-vinyl-alcohol (PVA); fleas and lice were cleared with sodium hydroxide and mounted in balsam. The ticks and larval insects were identified without mounting.

Results and Discussion

Egoscue (1956) states that previous to excavation the den was occupied by a family of six, the female fox and five pups and that

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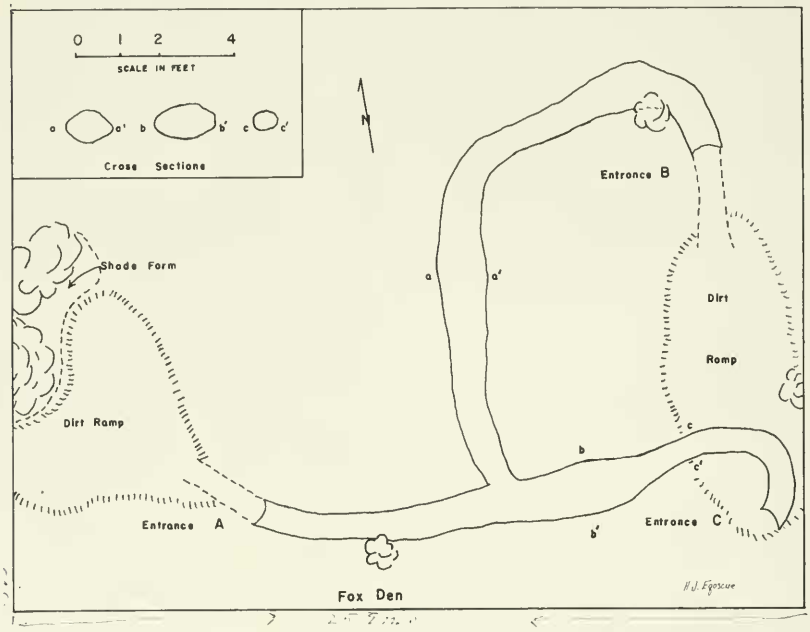
they abandoned the den May 16, 1955. The den was excavated following three days of surveillance to make sure the fox did not return. It was located in a geological lake bottom sparsely vegetated primarily with scadscale, *Atriplex confertifolia*, three miles west of Little Granite Mountain, Dugway Proving Grounds, Tooele County,



Fox Den

Utah. Egocue has described the environmental responses and proposed several reasons why a fox would abandon its den.

From field observations, scat analysis, and through recovery of the remains of prey not completely consumed Egoscue (1956) has identified the following as prey species of the kit fox: black-tailed jack rabbit, *Lepus californicus;* kangaroo rat, *Dipodomys ordii;* deer mouse, *Peromyscus maniculatus;* burrowing owl, *Speotyto cunicularia;* horned lark, *Eremophila alpestris;* meadow lark, *Sturnella neglecta;* brown-shouldered lizard, *Uta stansburiana;* and the sand cricket, *Stenopelmatus* sp.

Because of specific interest in arthropods potentially capable of disease transmission the majority of this discussion will be limited to this group. The reader interested in ectoparasites collected from the kit fox is referred to Egoscue's (1956) study.

Class Insecta:—The non-parasitic insects collected are scavenger species and are distributed throughout the locality (Table II). This discussion will make no further reference to this group. Regarding

the single species of Mallophaga (*Felicola vulpis* (Denny)) collected, Hopkins and Clay (1952) give *Vulpes* as the only host from which this species has been collected. Since lice normally pass through their entire life cycle on the host, the den or nest would not be expected to yield a large number of these insects.

Pulex irritans L. was collected repeatedly from foxes trapped during Egoscue's (1956) study; therefore, its presence would be expected in the fox den. *P. irritans* is commonly associated with the larger carnivores and man (Smit, 1958) and is capable of transmitting plague to man (Eskey and Haas, 1940). However, Smit (1958) feels that its significance in maintaining natural reservoirs of plague has been overestimated. Since the re-recognition of *P. simulans* Baker by Smit (1958), much of the work on plague transmission within this flea complex must be re-evaluated.

The fleas *Monosyllus wagneri* Baker and *Meringis parkeri* Jordan have not been collected from the fox. However, both have been repeatedly collected from the rodents *D. ordii* and *P. maniculatus*.

TABLE I. Location of soil collection sites in kit fox den.

Entrance A		Entrance B		Entrance C	
Collection number	Depth within den	Collection number	Depth within den	Collection number	Depth within den
1	At entrance	1	At entrance	1	At entrance
2	6 in.	2	6 in.	2	6 in.
3	12 in.	3	12 in.	3	12 in.
4	18 in.	4	18 in.	4	18 in.
5	30 in.	5	30 in.	5	30 in.
6	64 in.	6^0	64 in.		
7	76 in.	6^1	88 in.		
8	88 in.	6^2	112 in.		
		6^3	138 in.		
		6^4	162 in.		
		7	174 in.		
		8	186 in.		

Table II. Arthropod consortes collected in the fox den.

Arthropod Consortes	Number of Specimens
Class Arachnoidea	
Order Acarina	
Suborder Mesostigmata	
Superfamily Gamasides	
Family Laelaptidae	
Haemolaelaps glasgowi	large numbers*
Haemolaelaps casalis	large numbers
Superfamily Ixodoidea	
Family Argasidae	
Ornithodoros parkeri	26 larvae
Family Ixodidae	
Dermacentor parumapertus	20 larvae and nymphs
Ixodes kingi	1 larva
Ixodes texanus	112 larvae and nymphs
Class Insecta	
Order Coleoptera**	
Family Staphylinidae	2
Family Histeridae	12
Family Tenebrionidae	
Tenebrio sp.	1
Family Trogidae	
Trox sp.	23
Order Isoptera	1
Order Mallophaga	
Family Trichodectidae	
Felicola vulpis	3
Order Siphonaptera	
Family Ceratiphyllidae	
Monopsyllus wagneri wagneri	1
Family Hystrichopsyllidae	
Meringis parkeri	1
Family Pulicidae	
Pulex irritans	5
Unidentified larvae	62

*Hundreds of mites were collected at each sample location. Subsamples of ten from each location were identified.

**Three specimens of larval Coleoptera and one of Lepidoptera were collected but not identified.

Table III. Location in the den where arthropods were collected.*

Fleas	Ticks	Mites	Lice	Beetles	*Ornithodoros parkeri*
1 A**	1 A	6 A	7 A	2 A	6 A
2 A	2 A	7 A	3 C	5 A	7 A
7 A	4 A	8 A	5 C	6 A	8 A
2 B	5 A	6^{2}B		7 A	6^{1}B
5 B	6 A			2 B	6^{3}B
6^{3}B	7 A			5 B	6^{4}B
3 C	8 A			6^{0}B	
	1 B			6^{2}B	
	2 B			2 C	
	3 B			3 C	
	4 B			5 C	
	6^{0}B				
	6^{1}B				
	6^{2}B				
	6^{3}B				
	6^{4}B				
	5 C				

*Refer to Table I for reference to collection data.

**A, B, and C represent the entrances to the den.

Since their relative numbers (Table II) were very low, it may be assumed these specimens were introduced into the den on animals used for food. *M. wagneri* has been shown to be a potential vector of plague (Eskey and Haas, 1940). Information on *M. parkeri* as a potential vector of diseases is not available.

Class Archnoidea:—Although frequently collected from hosts within this study area, *Haemolaelaps casalis* (Berlese) (= *H. megaventralis*), and *H. glasgowi* (Ewing) have not previously been collected from the kit fox nor its den. In nature, *H. casalis* has been obtained most often from debris rather than from the host's body (Strandtomann and Wharton, 1958). This is not necessarily the case with *H. glasgowi*. Both are collected from a wide range of hosts.

Strandtmann and Wharton (1958) designate *H. glasgowi* as one of the known cosmopolitan mites. Russian workers, according to Strandtmann and Wharton (1958, p. 39), have reported this species to be naturally infected with tularemia and that they successfully transmit the disease. From the large numbers collected (Table II) it appears that the kit fox den is a natural habitat for these mites.

Ornithodoros parkeri Cooley is distributed throughout the eastern and southern parts of Utah and surrounding states. Previous to this study, *O. parkeri* had not been collected in the Great Basin, with the possible exception of a few collections in Nevada (Cooley and Kohls, 1944). Recently, collections in addition to those made during this study have been made from kangaroo rat caches (Johnson, personal communication)[4] in Tooele County, Utah. Collection data show that this tick is usually associated with dens, burrows, and food caches rather than with the host proper (Cooley and Kohls, 1944). It was of considerable interest to note that this tick was collected only in the deeper portions of the den (Table III). Several diseases have been experimentally transmitted by this tick (Davis, 1941). Ticks having natural infestations of relapsing fever spirochetes have often been collected in Utah and adjacent states (Davis, 1941, 1942). The identification of *O. parkeri* is only provisional since it was made from larval specimens. Two other related argasid ticks are found within the area; a behaviorally atypical *O. hermsi* Wheeler, Herms and Meyer (Davis and Mavros, 1956), and possibly *O. cooleyi* McIvor (Cooley and Kohls, 1944).

Ixodes texanus Banks was collected from the kit fox by Egoscue (1956), establishing a new host record. Infrequently this tick has been collected within the study area (Woodbury, 1956) in small numbers. Darsie and Anastos (1957) state that *I. texanus* is not in the least host specific. They list approximately 40 mammals as hosts. However, the larger collections have been made from weasels, pine squirrels, raccoons, and skunks. The relatively large numbers collected (Table II) would suggest that the kit fox den is a natural habitat for this species.

Ixodes kingi Bishopp has not previously been collected from the kit fox nor its den, although it has been frequently collected from native rodents (Allred, 1955). The single specimen collected (Table II) would suggest its introduction into the den via prey animals.

Dermacentor parumapertus Neumann is the most commonly collected tick locally, and may be collected from essentially any small mammal in the area. Due to the abundance of this tick and to the associations the fox has with other mammals, its presence in the den is readily explained. This tick is a potential vector of tularemia (Woodbury and Parker, 1954).

Summary

.....Two species of fleas, two species of ticks and one mite of known medical importance have been recovered from the kit fox den. The

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ticks *I. kingi*, *I. texanus* and *O. parkeri* represent new host and/or distribution records. *H. casalis*, *H. glasgowi*, *I. texanus*, *O. parkeri*, *F. vulpis* and *P. irritans* appear to be natural associates of the kit fox. The remainder of the arthropods are scavengers or considered to be accidental transfers from prey animals.

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